

PSYCHE.

THE ORTHOPTERAN GENUS HIPPISCUS.

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Hippiscus was established by Saussure in 1861 as a subgenus of Oedipoda on a large Mexican grasshopper to which he gave the name of ocelote. Only a brief diagnosis of the group was given, and no attention was paid to it until 1873, when Stål, who regarded it as a genus, gave much greater precision to its definition through the tables in his Recensio Orthopterorum and placed Serville's well known *Oedipoda discoidea* in the group. Subsequently, in 1874, I referred here *Oe. rugosa* Scudd. and, in 1876, *Oe. neglecta* Thom., *Oe. haldemanii* Scudd. and *Oe. corallipes* Hald. Finally, in 1884, Saussure in his Prodromus Oedipodiorum described a number of new forms and separated them into two series, which he termed Hippiscus and Xanthippus, regarding each as a genus, and further divided the former into two subgenera,—Hippiscus proper and Pardalophora.

Although I have been unable to examine two of the species described by Saussure, so large a number of new forms have been found in our country, especially in the region west of the Mississippi, and so great a confusion exists regarding them in our collections and in the writings of our entomologists, that I have

ventured to subject them all to a critical study, the result of which is offered in the following pages. As will be seen, I am inclined to regard Saussure's two genera as but subdivisions of one generic group, and to discard his subgenus Pardalophora altogether; at the same time I have applied a third subgeneric name, Stictippus, to forms which are closely related to Hippiscus and Leprus. My *Leprus ingens* which Saussure, without seeing, put in Xanthippus with a query, I am now inclined to regard as the type of an undescribed genus allied to Leprus but distinct and remarkable for the bulky form of the female.

Though it seems most reasonable to consider these subdivisions as of less than generic rank, there would seem to be ground for regarding them as of some importance, for it will be noted by the observant that the subgenus Hippiscus is an eastern type, rarely occurring beyond the Sierra Nevadas*, and that Stictippus is confined to the Pacific slope, while Xanthippus occurs with Stictippus on the Pacific Coast, and

*Exception may possibly be made to this, for Walker records *H. tuberculatus* from the West Coast; but apart from the fact that this species forms a group by itself within Hippiscus and has an anomalous distribution even to within the Arctic Circle, I believe this is either an error of determination or of location.

with Hippiscus throughout the centre of the continent, but is altogether wanting on the Atlantic coast, no species occurring nearer than Iowa, Nebraska, and Kansas; none even reach the Mississippi River.

In the preparation of the present paper I have studied more than five hundred and fifty specimens, the larger part of which were in my own collection, but

I have had the advantage of seeing all those in the collection of Mr. Samuel Henshaw of Cambridge, and a full series of those belonging to Mr. Lawrence Bruner of Lincoln, Neb. to both of whom I am indebted for many courtesies. Dr. C. V. Riley has also kindly sent for my examination types of two or three of Thomas's species of which I was in doubt.

TABLE OF THE SPECIES OF HIPPISCUS.

- A¹.* Antennae of male not attenuate or arcuate at the extremity; carina of pronotum intersected only by the typical sulcus, which is obsolete or rapidly fades out on the lateral lobes; posterior femora generally more dilated and the inferior border more arcuate.
- B¹.* No distinct sunken biareolate area at the summit of the frontal costa; if vaguely present, separated from the costa below by no carina or angle. Lateral walls of normal discal scutellum of prozona not cut deeply by an inner fork of its posterior sulcus, which indeed often does not exist. Medina carina sharply distinct throughout. Markings of the tegmina usually pantherine. Mesosternal lobes separated by a piece rather quadrate than truncato-cuneate, though the posterior corners of the lobes are rounded, but narrowly and abruptly. . . (HIPPISCUS.)
- c¹.* Anterior extremity of scutellum of vertex not prolonged, narrowing rapidly, in front (excl. *H. pantherinus*) as broad as or broader than half the middle width; hind margin of pronotum usually rectangulate; markings of tegmina distinctly pantherine.
- d¹.* Frontal costa distinctly, often considerably, narrowed at its upper extremity, except in some ♀ hardly or even less than a fourth the width of the space between the eyes, the scutellum of the vertex rarely furnished with transverse carinae, then generally faint, and the longitudinal carina terminating in the centre with rare exceptions; tips of the wings in the ♂ rarely or but slightly clouded; extreme base of the area of the ulnar fork of tegmina usually not involved in the darker markings; calcaria of opposite sides of hind tibiae subequal.

- e¹.* The lower third of tegmina free from dark markings, except in the anal area; markings of tegmina hardly pantherine; tegmina tapering and basal lobe of costal margin prominent, the width of the tegmina at this point being fully a third greater than at the tip of the lower ulnar vein; lateral carinae of pronotum not very sharp. (*H. phoenicopterus*)
- e².* Not more than the lower fourth of tegmina, if any, free from dark markings; markings of tegmina distinctly pantherine; tegmina subequal and basal lobe of costal margin less pronounced, the width of the tegmina at this point being scarcely more than a sixth greater than at the tip of the lower ulnar vein; lateral carinae of pronotum sharp.
- f¹.* Vertical scutellum hexagonal or heptagonal, broader than long, the sides very rapidly narrowing in front and distinctly angulate next the front edge of the eye; light transverse markings of apical half of tegmina scarcely more than half as broad as the darker markings. (*H. pantherinus*)
- f².* Vertical scutellum longer than broad, pyriform, the sides distinctly rounded and less rapidly narrowing; light markings of apical half of tegmina almost or quite as broad as or even broader than the darker markings.
- g¹.* Granules on dorsum of metazona by their confluence distinctly following lines forming oblique rugae parallel to the hind margin; lateral canthi of pronotum as distinct and sharp on the hinder part of the prozona as on the front part of the metazona. (*H. haldemanii*)
- g².* Granules on dorsum of metazona rarely confluent and when confluent showing no marked tendency to follow lines parallel to hind margin; lateral canthi of pronotum much less distinct and duller on hinder part of prozona than on front part of metazona. (*H. texanus*)
- d².* Frontal costa not at all or scarcely in the least narrowed at its upper extremity, always more than a third, sometimes nearly a half, the width of the space between the eyes, the scutellum of the vertex divided by longitudinal and transverse carinae into four subequal quadrants; tips of the wings in the ♂ usually clouded, the large central dark spot of the tegmina usually involving the extreme base of the area of the ulnar fork of the tegmina; calcaria of hind tibiae markedly unequal on opposite sides.
- e¹.* Lateral canthi of pronotum not very sharp, interrupted and devious between the sulci; metazona of ♀ distinctly longer than prozona.

- f*¹. Relatively slenderer forms, the tegmina relatively slenderer; last, forked branch of the discoidal vein of the hind wings usually arising about three fifths the distance from the base to apex of the wing, and in ♂ usually well within the limits of the transverse fuscous belt; closed tegmina of ♂ surpassing the abdomen by at least one fourth their length. (*H.*) *rugosus*.
- f*². Relatively stouter bodied forms, the tegmina relatively broader; last, forked branch of the discoidal vein of the hind wings usually arising at about two thirds the distance from the base to apex of the wing, and in ♂ at the outer edge of the transverse fuscous belt; closed tegmina of ♂ surpassing the abdomen usually by less than one fourth their length.
- g*¹. Dark markings of outer fourth of tegmina clustered into regular connected transverse series. (*H.*) *compactus*.
- g*². Dark markings of outer fourth of tegmina forming irregularly distributed minor maculations.
- h*¹. Markings of tegmina distinctly pantherine, marginal field with numerous small blotches; wings of ♂ fully twice as long as broad; hind margin of prothorax rectangulate. (*H.*) *variegatus*.
- h*². Markings of tegmina hardly pantherine, resembling many species of *Trimerotropis*, marginal field mostly occupied by two large spots; wings of ♂ scarcely twice as long as broad; hind margin of prothorax obtuse angulate. (*H.*) *suturalis*.
- e*². Lateral canthi of pronotum acute, continuous throughout, arcuate; metazona of ♀ scarcely longer than the prozona. (*H.*) *ocelote*.
- c*². Anterior extremity of scutellum of vertex prolonged, narrowing gradually, in front less than half as wide as in the middle; hind margin of pronotum acutely angled (rarely, by variation, rectangulate); markings of tegmina hardly or not at all pantherine.
- d*¹. Metazona with two pairs of distinct lateral rugae parallel to hind margin; basal discoidal field of tegmina, including the ulnar area, broadly maculate; apical half of tegmina multimaculate; ulnar taenia of hind wings stopping far short of the base of the wing, the intermediate space filled with closely crowded cross veins; veins at end of humeral field more or less laterally stained with blackish fuscous at the cross veins, rarely absent. (*H.*) *saussurei*.
- d*². Metazona without lateral oblique rugae; basal discoidal field of tegmina, and especially the ulnar area, almost or quite immaculate; apical half of tegmina paucimaculate; ulnar taenia of hind wings almost reaching the base of the wing, the cross veins next the

base not closely crowded; veins at end of humeral field immaculate. (*H.*) *tuberculatus*.

*B*². At the point where the scutellum of the vertex and the frontal costa meet, between the apices of the lateral foveolae, a distinct sunken transversely biareolate field or frontal fastigium easily distinguished both from the vertical scutellum and the frontal costa. Posterior sulcus of the prozona terminating on the typical sulcus in two forks, one at the lateral borders of the normal discal scutellum, the other, by deeply cutting the lateral walls of that scutellum, close to the median line. Median carina of metazona posteriorly more or less subobsolete in the ♀. Markings of the tegmina not distinctly pantherine. Mesosternal lobes separated by a truncate but distinctly wedge-shaped median piece, the posterior corners of the lobes being very broadly rounded.

(*STICTHIPPUS.*)

*c*¹. Axillary vein of tegmina of ♀ in no way entangled with the anal vein; maculations of apical third of tegmina obscure; humeral field of wings uniformly infuscate apically. . . . (*S.*) *californicus*.

*c*². Axillary vein of tegmina of ♀ more or less entangled apically with the anal; maculations of tegmina as distinct on apical third as elsewhere; humeral field of wings apically maculate.

(*S.*) *marmoratus*.

*A*². Antennae of male attenuate or arcuate, in dried specimens often partly coiled at the extremity; carina of pronotum intersected by two sulci, and generally obliterated between them, but sometimes indicating the anterior sulcus only by sinuation; posterior femora generally less dilated, the inferior border less arcuate.

(*XANTHIPPUS.*)

*b*¹. Antennae of ♂ usually as long as the hind femora, gradually attenuated apically for at least one fifth their length, curled, cochleate, or hooked at the tip in drying. Tegmina distinctly pantherine in markings, occasionally obscured (in variation) by obsolescence; intercalary vein arcuate, approaching at least twice as close to the median at its apex as near its base. Fuscous transverse band of wings so far removed from apex as to leave a vitreous area, especially in the ♀, covering four marginal lobes or even more. Pronotal carina with rare exceptions more or less obliterated between the principal sulci. Summit of cranium commonly carinulate between the eyes.

*c*¹. Male of medium or large size. Tegmina surpassing the abdomen in both sexes; area of the ulnar fork rarely filled with only a single,

usually with a complete double, row of cells. Metazona usually tumid centrally to a greater or less extent, and considerably depressed or indentate anteriorly on either side the median carina.

d¹. Intercalary vein of tegmina near its extremity running so close to the median as commonly to be hardly separated from it by more than its own thickness; markings of tegmina sharp and well defined; transverse band of wings distinctly narrowed, sometimes obsolescent, at the anal vein; process of metazona normally less than a right angle.

e¹. Bounding walls of the vertical scutellum and other carinae of the vertex generally dull and low; metazona about two thirds as long again as the prozona, its dorsum variable, its rugosities not very prominent, rarely confluent; transverse fuscous band of wings usually very broad, in the second lobe below the anal vein often more than twice as broad as the width of the lobe.

f¹. Species of great size; maculations on apical third of tegmina often obscure by lack of depth of color, lessening the contrasts between the darker and the lighter spots, but sometimes sharp and well defined; fuscous band of wings generally very dark; inside of hind femora usually blue except the red apical third.

(*X.*) *corallipes*.

f². Species of rather small or medium size; maculations on apical third of tegmina generally pure and with distinct contrasts; fuscous band of wings generally fuliginous; inside of hind femora usually wholly red. . . . (*X.*) *zapotecus*.

e². Bounding walls of the vertical scutellum and other carinae of the vertex usually sharp and relatively high; metazona twice as long as prozona, its dorsum centrally tumid, its rugosities prominent and usually more or less confluent; transverse fuscous band of wings usually narrow or moderate, in the second lobe below the anal vein rarely so much as twice the width of the lobe.

f¹. Transverse pale band of anterior margin of tegmina opposite the middle of intercalary vein but little broader than the others; fuscous band of wings narrow, hardly touching the margin anywhere and often widely interrupted between the arcuate fascia and the humeral vitta.

g¹. Darker markings occupying one half or more of the tegmina, normally and completely continuous in the middle half of the tegmina and usually broader than the pale interspaces.

(*X.*) *conspicuus*.

- g².* Darker markings occupying much less than one half of the tegmina, broken or partially broken by the nervules into maculations in the middle of the tegmina and usually narrower than the pale interspaces. (*X.*) *eremitus.*
- f².* Transverse band of anterior margin opposite middle of intercalary vein much, generally twice or more, broader than the others; fuscous band of hind wings moderately broad, reaching the margin over half its course and hardly or but slightly interrupted at the anal vein. (*X.*) *pardalinus.*
- d².* Intercalary vein of tegmina separated near extremity from the median by a moderately wide space; markings of tegmina often somewhat blurred or ill defined, but sometimes perfectly sharp; transverse band of wings generally narrowed somewhat at the anal vein, but less noticeably than in the alternative category and never obsolescent; process of metazona normally rectangulate.
- e¹.* Fuscous markings of the apical half of tegmina hardly occupying so much as half the space, arranged in generally transverse, well defined blotches rarely so long as half the breadth of the tegmina.
- f¹.* Rugosities of dorsum of pronotum irregularly distributed; median carina of metazona but slightly elevated, scarcely arched; transverse fuscous bars of tegmina with tolerably regular, rounded, and sharply limited outlines; hind femora distinctly and very obliquely barred exteriorly. (*X.*) *maculatus.*
- f².* Rugosities of dorsum of metazona more or less distinctly ranged into series parallel to the two sides of the process; median carina of same considerably elevated, distinctly arched; transverse fuscous bars of tegmina scarcely rounded, with ill defined irregular margins on apical half; hind femora obscurely or not at all barred exteriorly. (*X.*) *tigrinus.*
- e².* Fuscous markings of apical half of tegmina occupying fully three fourths its area, arranged in well defined transverse bars nearly or quite crossing the tegmina.
- f¹.* Dorsum of prothorax with very prominent, often sharp, rugosities; fuscous band of wings very broad, not at all narrowed at the anal vein. (*X.*) *leprosus.*
- f².* Dorsum of prothorax with less prominent, though coarse but dull rugosities; fuscous band of wings narrow or if of medium width then distinctly and considerably narrowed at the anal vein.
 (*X.*) *paradoxus.*

*e*³. Fuscous markings of apical half of tegmina irregularly maculate with a tendency to a transverse arrangement but with ill defined very irregular margins and occupying perhaps half the whole area.

*f*¹. Dorsum of prothorax more heavily and coarsely rugulose; tegmina relatively long, distinctly surpassing the abdomen in the ♀; the darker tints of the tegmina generally prevail over the lighter, particularly in the middle of the tegmina; fuscous band of wings relatively broad. (*X.*) *affictus*.

*f*². Dorsum of prothorax less heavily and coarsely rugulose; tegmina relatively short, not exceeding the abdomen in the ♀; darker tints of tegmina subordinate to the lighter, particularly in the middle of the tegmina; fuscous band of wings relatively narrow. (*X.*) *toltecus*.

*c*². Male of small size. Tegmina of ♀ shorter than the abdomen; area of the ulnar fork rarely filled with more than a single row of cells and then only for a portion of its length. Metazona plane above, with obscure or no indentation anteriorly.

*d*¹. Shoulder (or extreme base of front margin) of tegmina as dark as the rest of the base; markings of tegmina more or less obscure and blurred. (*X.*) *ativolus*.

*d*². Shoulder of tegmina with paler markings contrasting with the rest of the dark base; all markings of tegmina sharp and distinct.

*e*¹. Antennae of ♀ almost as long as the pronotum; pronotum of ♀ nearly half as long again as its extreme dorsal width.

(*X.*) *cupidus*.

*e*². Antennae of ♀ considerably shorter than the pronotum; pronotum of ♀ but little longer than its extreme dorsal width.

(*X.*) *pumilus*.

*b*². Antennae of ♂ distinctly shorter than the hind femora, apically attenuate for rarely more than one eighth their length, at most arcuate or broadly uncinate in drying. Tegmina rarely though sometimes distinctly pantherine, usually irregularly mottled with moderately large alternate blotches of dark fuscous and gray, and apically dotted with pale fuscous; intercalary vein usually straight, rarely approaching the median much nearer at its apex than next its base, never more than twice as close. Fuscous transverse band of wings so near the apex that even in the ♀ rarely more than two marginal lobes are covered by the sometimes apically infuscated vitreous area. Pronotal carina sometimes scarcely subdued between the principal sulci. Summit of cranium commonly not carinulate between the eyes.

- c*¹. Median carina of pronotum usually almost entirely obliterated between the anterior and principal sulci; markings of the tegmina distinctly pantherine; inferior carina of hind femora high and strongly arcuate.

*d*¹. Markings of tegmina mostly confined to the anterior half or three-fifths; apex of axillary field pallid; fuscous band of wings somewhat obscure, very narrow, narrowed at the anal vein; hind tibiae yellow. (*X.*) *albulus*.

*d*². Markings of tegmina crossing them; apex of axillary field dark; fuscous band of wings distinct, very broad, not narrowed at the anal vein; hind tibiae red. (*X.*) *latefasciatus*.

*c*². Median carina of pronotum usually distinct between the anterior and principal sulci; markings of the tegmina not pantherine but more or less marmorate, much after the pattern of *Trimerotropis*; inferior carina of hind femora usually normal, rarely high or strongly arcuate.

*d*¹. Lateral lobes of pronotum slightly wider below than in the middle by the retroarcuate curve of the hind margin; inferior carina of hind femora not prominent.

*e*¹. Band of hind wings broad, leaving not more than two lobes apically free. (*X.*) *obscurus*.

*e*². Band of hind wings usually less broad, leaving more than two lobes apically free. (*X.*) *neglectus*.

*d*². Lateral lobes of pronotum equal, the hind margin vertical and not retroarcuate; inferior carina of hind femora more or less prominent.

*e*¹. Lower intercalary area of tegmina broad, densely filled with anastomosing nervules, generally more densely than in the area beneath it; lateral canthi of thorax almost entirely confined to metazona.

*f*¹. Vertical fastigium shallow with low lateral walls, the frontal fastigium (or the front part of the vertical fastigium at its junction with the frontal costa) not deeply impressed, widely connected with the vertical fastigium. Antennae in both sexes as long as the head and pronotum. Hind margins of metazona entire; anal line of tegmina pallid; axillary vein of tegmina free. (*X.*) *montanus*.

*f*². Vertical fastigium deep with high walls, the frontal fastigium deeply impressed, with a constricted connection with the vertical fastigium. Antennae of ♀ shorter than the head and pronotum. Hind margins of metazona crenulate; anal line of tegmina concolorous; axillary vein of tegmina apically united to the anal.

- g*¹. Frontal costa much more constricted above than below the ocellus; wings bright red or yellow at base.
- h*¹. Anterior portion of metazona transversely plicato-rugose; axillary vein united distally with the anal. (*X.*) *lateritius*.
- h*². Anterior portion of metazona rugose without sign of transverse plications; axillary vein free or intermediately united distally with the anal. (*X.*) *calthulus*.
- g*². Frontal costa scarcely more constricted above than below the ocellus; wings pale lemon yellow at base. (*X.*) *griseus*.
- e*². Lower intercalary area of tegmina not always broad, no more densely filled with anastomosing nervules than the area beneath; lateral canthi subcontinuous across thorax and straight. Process of metazona rectangulate.
- f*¹. Median carina of pronotum distinct throughout the prozona and scarcely less so between the principal sulci than in front; outer border of band at apex of wing distinct. (*X.*) *vitellinus*.
- f*². Median carina of pronotum nearly obliterated between the principal sulci; outer border of band at apex of wings often obscure.
- g*¹. Markings of tegmina relatively distinct and abundant, the apical half distinctly mottled; the postmedian spot large and no more conspicuous than the others; arcuate band of wings nearly or quite reaching the anal angle. (*X.*) *aurilegulus*.
- g*². Markings of tegmina scant and obscure, the apical half dark fuliginous with few or no mottlings; the postmedian spot small and more conspicuous than the others; band of wings hardly reaching more than half way to anal angle. (*X.*) *stigmosus*.

Subgenus HIPPISCUS.

HIPPISCUS (H.) PHOENICOPTERUS.

Oedipoda phoenicoptera Germ!, Burm., Handb. ent., 2, 643.

Hippiscus phoenicopterus Sauss., Prodr. Oedip., 87; McNeill, Psyche, 6, 63.

Oedipoda discoidea Serv!, Hist. nat. Orth., 724; Scudd!, Bost. journ. nat. hist., 7, 469; Glov., Ill. N. A. ent., Orth., pl. 3, figs. 3, 7; Thom., Syn. Acrid. N. A., 133-135.

Hippiscus discoideus Stål, Rec. Orth., 1, 121; Thom., Bull. Ill. mus., 1, 66; Rep. ent. Ill., 9, 95, 116-117; Scudd!, Proc. Bost. soc. tan. hist., 19, 90.

In the collection at Halle I saw a ♂ of this species labelled *Oe. phoenicoptera* in Burmeister's handwriting and purporting to come from South Carolina collected by Zimmermann; though not marked as a type specimen, there can be little doubt that it is one of the types, and I am thus able to correct (as others have already done) the mistake of my earliest reference to this species. I have also seen the Georgia type of Serville's *Oe. discoidea* in the Jardin